2.0 PRIORITIZATION OF BASINS
BY INDIVIDUAL CRITERIA

The following presents the approach used to rank the tertiary basins for each criterion. The data sources, methods, and important assumptions used to arrive at relative ranks for the basins are defined, and tabular and graphical outputs illustrate the results for each criterion considered. Relative rankings of the tertiary basins are broken into three groups, with the top 25% of the basins relative to each criterion labeled as **high impact**, or priority, basins. The middle 50% of the basins with respect to each criterion is labeled as **medium impact**, and the remaining bottom 25% is labeled as **low impact**. Appendix A contains a complete listing of the ranked basins by criterion.

Relative rankings of the tertiary basins are presented based on both total criterion values and area-weighted criterion values. Relative rankings based on total criterion values result in determination of which tertiary basins represent the greatest sources of loadings in an absolute sense. Relative rankings of tertiary basins based on area-weighted criterion values result in determination of which tertiary basins represent the greatest intensity of loadings from the watershed. Management decisions can thus be formulated based on total loads and/or loading intensity.

2.1   Urban Runoff Discharge

Urban development has changed the natural landscape within the study area, and this has resulted in changes in the physical manner in which runoff responds to rainfall. Replacement of wetlands and forests with impervious surfaces, such as asphalt pavement, rooftops, and concrete sidewalks, has led to increased runoff rates from the land surface. This has contributed to the excessive freshwater discharges to the estuary observed during periods of high rainfall. On-site and regional stormwater management systems have been constructed and continue to be constructed within the study area in an effort to ameliorate the impacts of these changes to the land surface. For the purposes of this ranking effort, the stormwater management systems were assumed to be uniformly distributed among the tertiary basins, and a detailed rainfall and GIS land cover model was used to estimate relative urban runoff discharge rates for the basins.

Typical rainfall conditions were estimated using rainfall monitoring data collected by both the National Weather Service and SFWMD. Using this surface-fitting approach, rainfall values for each month were computed for each of the tertiary basins by estimating mean monthly values averaged over the years from each of the monitoring stations by the following equation:

$$\hat{p}_{j,t} = \frac{\displaystyle\sum_{k=1}^{K_j}\left[P_{k,t}\frac{1}{D_k^2}\right]}{\displaystyle\sum_{k=1}^{K_j}\left[\frac{1}{D_k^2}\right]}$$

where $\hat{p}_{j,t}$ = estimated total monthly precipitation in the tth month for the jth tertiary basin,

K_j = number of precipitation monitoring stations used to estimate precipitation in the jth tertiary basin,

$P_{k,t}$ = total monthly precipitation in the tth month recorded at the kth precipitation monitoring station, and

D_k = distance between the geographic center of the jth tertiary basin and the kth precipitation monitoring station.

The geographic centroid of each tertiary basin was computed as the area-weighted center of its basin boundary.

Urban runoff discharge was calculated by applying the tertiary basin- and monthly-specific rainfall estimates to a detailed GIS land cover and soil characteristics database that was developed for this project (PBS&J, 1999). Land cover was delineated from 1995, 1:24,000 scale, color infrared photography of the watershed, and hydrologic soil groups were compiled from three county-specific soil surveys (USDA, 1984, 1984, and 1990).

Monthly-specific runoff discharge estimates were computed for each individual parcel of land within a tertiary basin for a year, using monthly rainfall averaged over the period of record. Discharge was computed by multiplying the rainfall estimate by a literature-based runoff coefficient value. Runoff coefficients used for these analyses were specific for south Florida, varied by land use/cover and hydrologic soil group, and were adjusted for wet or dry season conditions. The runoff coefficients used for these analyses are presented in Appendix B. For the final step in this calculation, runoff discharge estimates for each individual urban land parcel within a tertiary basin were summed across urban land use types to compute the total expected urban runoff discharge for that tertiary basin and month. This process is shown in the following equation:

$$\hat{q}_{j,t} = \sum_{s=1}^{S} \sum_{l=1}^{L} A_{j,s,l}\ \hat{p}_{j,t}\ C_{s,l,t}$$

where $\hat{q}_{j,t} =$ estimated total monthly runoff discharge in the tth month for the jth tertiary basin,

$A_{j,s,l} =$ area of soil type s in land use category l in the jth tertiary basin,

$\hat{p}_{j,t} =$ estimated total monthly precipitation in the tth month for the jth tertiary basin, and

$C_{s,l,t} =$ runoff coefficient for soil s and land use l in the tth month, with season-specific runoff coefficients for south Florida urban land uses.

The major urban land use types used in this calculation are those assigned to low, medium, and high density single family areas, multi-family and mobile home developments, institutional, commercial, and industrial facilities, transportation and utility land uses, those areas under development, and golf courses.

The tertiary basins were assigned relative ranks according to estimated total annual urban runoff discharge by summing across months. Table 2-1 presents these relative ranks; Table 2-2 presents the area-weighted relative ranks for urban runoff discharge. Figure 2-1 presents the results of the urban runoff discharge ranking of the 62 tertiary basins in the study area grouped as described previously into high, medium, and low impact basins. Figure 2-2 presents the area-weighted results of the urban runoff discharge ranking of the 62 tertiary basins in the study area.

Table 2-1.	Relative ranks of the top 25% of the tertiary basins within the Estero Bay Watershed for urban runoff discharge.					
Secondary Basin	Tertiary Basin (TB)	Area (acres)	% Urban Land Use	% Agricultural Land Use	Urban Runoff (acre-feet/yr)	Rank
Estero River	8	27647	16	27	8090	1
Six-Mile Cypress Slough	4	18354	20	23	7125	2
Mullock Creek	4	3596	81	7	6131	3
Imperial River	1	3464	61	0	4421	4
Barrier Islands	1	15726	13	0	4311	5
Hendrey Creek	10	2459	59	0	3769	6
Six-Mile Cypress Slough	1	8345	29	15	3742	7
Imperial River	4	4695	30	37	2709	8
Six-Mile Cypress Slough	3	3893	42	13	2467	9
Cow Creek	2	1864	61	0	2444	10
Ten-Mile Canal	11	2569	42	12	2308	11
Imperial River	3	1988	58	7	1932	12
Estero River	6	7467	15	27	1740	13
Spring Creek	7	2482	36	10	1494	14
Imperial River	2	1738	49	2	1403	15
Imperial River	6	41568	3	25	1400	16

The results of the unweighted analysis indicate that priority basins for urban runoff discharge include Tertiary Basin (TB) 8 in the Estero River Basin, TB 4 in the Six-Mile Cypress Slough Basin, and TB 4 in the Mullock Creek Basin. The latter tertiary basin differs from the former two in that it is a relatively small basin with predominantly (81%) urban land use. In contrast, the top two ranked tertiary basins are much larger but with a smaller proportion of urban land use (16-20%).

The priority basins with respect to urban runoff discharge are found in each of the secondary basins within the Estero Bay Watershed. The priority tertiary basins are in the Estero River Basin (two tertiary basin), the Six-Mile Cypress Slough Basin (three tertiary basins), the Mullock Creek Basin (one tertiary basin), the Imperial River (five tertiary basins), the Barrier Islands Basin, the Hendrey Creek Basin (one tertiary basin), the Cow Creek Basin (one tertiary basin), the Ten-Mile Canal Basin (one tertiary basin), and the Spring Creek Basin (one tertiary basin).

Table 2-2.	Relative ranks of the top 25% of the tertiary basins within the Estero Bay Watershed for area-weighted urban runoff discharge.					
Secondary Basin	Tertiary Basin (TB)	Area (acres)	% Urban Land Use	% Agricultural Land Use	Area-weighted Urban Runoff (acre-feet/yr)/acre	Rank
Hendrey Creek	6	449	63	7	1.76872	1
Mullock Creek	4	3596	81	7	1.70483	2
Ten-Mile Canal	4	153	67	0	1.63033	3
Hendrey Creek	10	2459	59	0	1.53293	4
Hendrey Creek	9	517	67	0	1.47858	5
Ten-Mile Canal	1	129	67	0	1.40605	6
Cow Creek	2	1864	61	0	1.31074	7
Hendrey Creek	8	863	66	7	1.28883	8
Imperial River	1	3464	61	0	1.2763	9
Estero River	4	124	64	0	1.23072	10
Cow Creek	4	132	74	0	1.16561	11
Ten-Mile Canal	7	404	47	0	1.06851	12
Ten-Mile Canal	9	1266	53	24	1.03585	13
Imperial River	5	202	63	0	1.0033	14
Imperial River	3	1988	58	7	0.97173	15
Ten-Mile Canal	11	2569	42	12	0.89831	16

The area-weighted rankings of the tertiary basins within the Estero Bay Watershed show that three of the top five basins are in the Hendrey Creek secondary basin (TB 6, 9, and 10) . Other highly ranked basins include TB 4 in the Mullock Creek Basin and TB 4 and TB 1 in the Ten-Mile Canal Basin.

To provide a comparison with the area-weighted urban runoff from the basins in Table 2-2, values from drainage basins within the Charlotte Harbor National Estuary Program (CHNEP) study area may be used. The range of area-weighted urban runoff discharge from the major basins in the CHNEP study area was from 0.08 acre-feet/yr/acre (for the Myakka River Basin) to 0.64 acre-feet/yr/acre (for the Coastal Venice Basin) (PBS&J and Bender, 1998). The area-weighted urban runoff from the entire Estero Bay Watershed is 0.39 acre-feet/yr/acre (Appendix A).
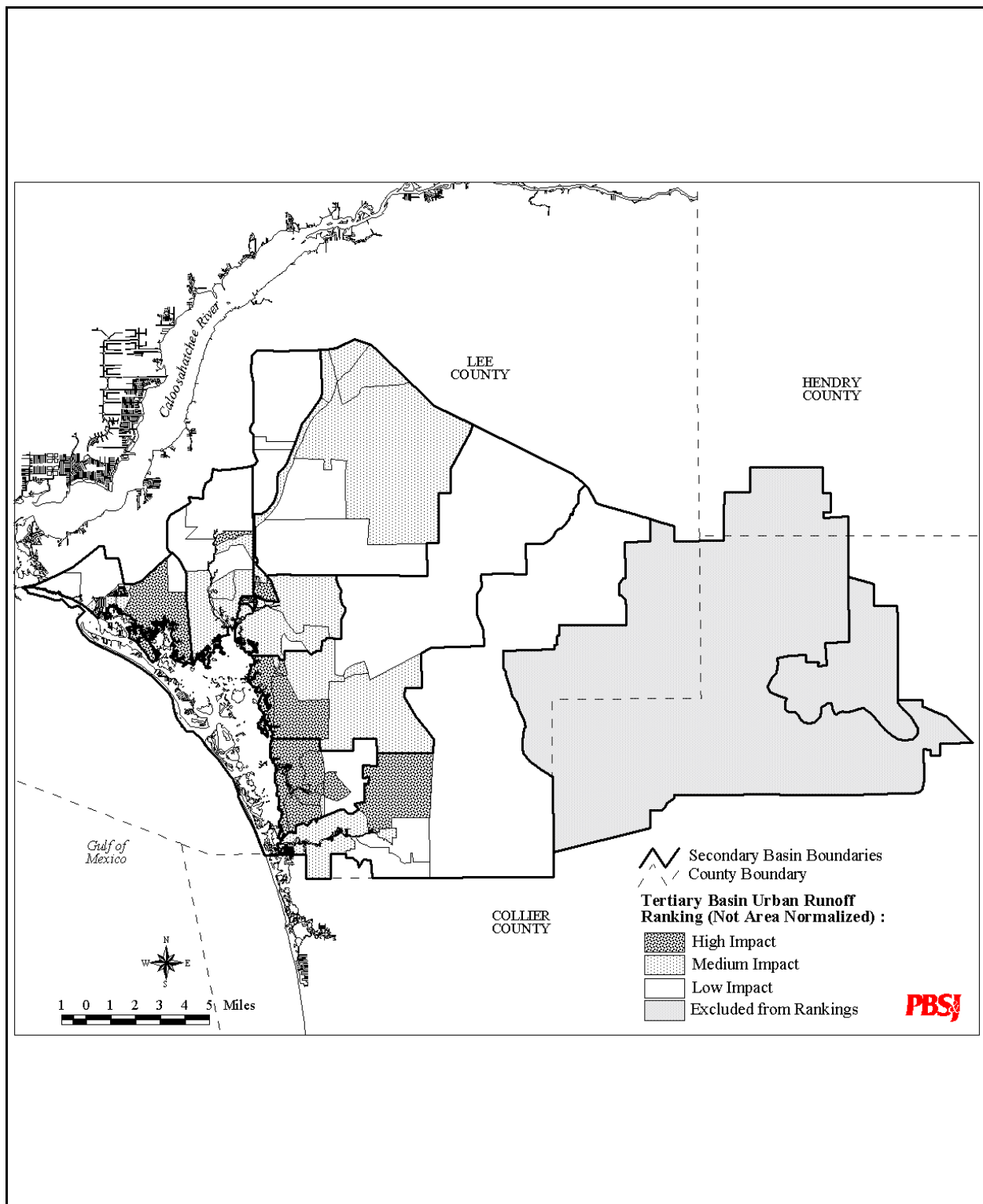
Figure 2-1. Tertiary basins classified by urban runoff discharge.
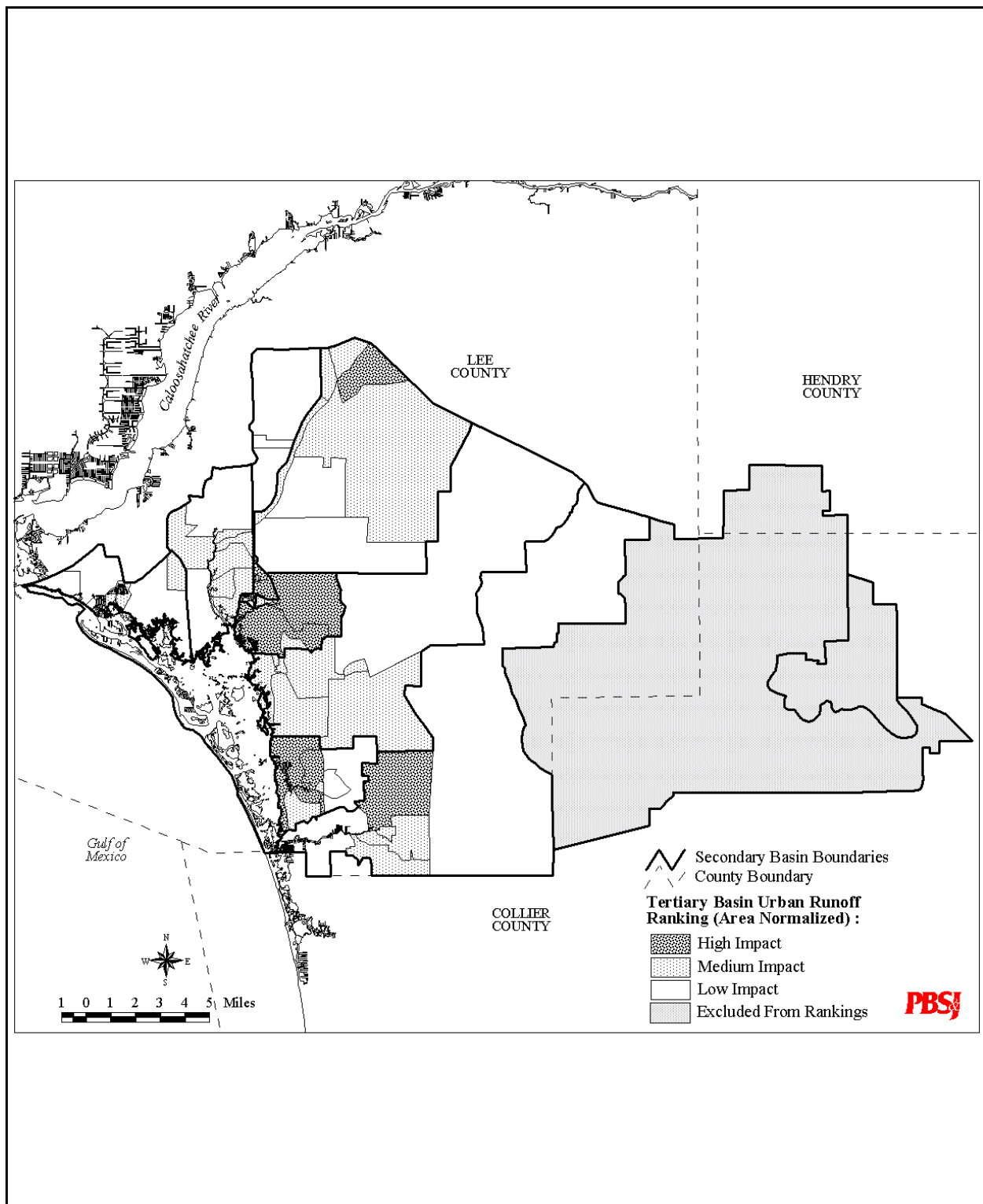
Figure 2-2. Tertiary basins classified by area-weighted urban runoff discharge.